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Flash floods and debris flow in the city area of Messina, North-East part of Sicily, Italy in October 2009: the case of the Giampilieri catchment

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Flash floods are phenomena in which the important hydrologic processes are occurring on the same spatial and temporal scales as the intense precipitation. Most of the catchment in the North-East part of Sicily (Italy) are small, with a steep slope, and characterized by short concentration times. These characteristics make those catchment prone to flash flood formation, as demonstrated by events that occurred in the area around Messina in the North-East part of Sicily, Italy in the last recent years. The events occurred on 25th October 2007 in the Mastroguglielmo torrent on the ionic sea coast, on 11th December 2008 in the Elicona catchment on the Tyrrhenian sea coast and on 1st October 2009 in Racinazzi and Giampilieri torrents on the ionic sea coast are an example of flash floods and debris flow events that caused not only significant economic damages to property, buildings, roads and bridges but also, for this that concern the 1st October 2009 flash flood event, loss of human life.

This work is aimed by the 1st October 2009 flash flood and debris flow event where a devastating flooding was caused by a very intense rainfall concentrated over the Messina area. The storm caused severe flash floods in many villages around the city of Messina, such as Giampilieri, Scaletta Zanclea, Altolia Superiore and Molino with forty casualties and significant damage to property, buildings, roads and bridges estimated close to 200 million Euro. Main focus of this work is to perform a post event analysis of the 2009 flash flood event, putting together available meteorological and hydrological data in order to get better insight into temporal and spatial variability of the rain storm, the soil moisture condition and the consequent flash floods in the catchment of the Giampilieri catchment. Starting from these information another objective has been, then, to document the post-failure stage of event concerning slid materials. With the help of GIS technology and particularly spatial analysis, volume of debris gone down for the Giampilieri catchment has been calculated. The event was investigated using observed data from a raingauge network and hydraulic evidences. Statistical analysis using GEV distribution was performed and rainfall return period (storm severity) was estimated. Further, measured rainfall data and rainfall-runoff modeling were used to analyze the hydrological behaviour and to reconstruct flood and debris hydrographs. The study confirmed that post-flood investigation should focus on discharges and hydrological response of the catchment rather than simply analyzing statistical characteristics of rainfall. Thanks to LIDAR data produced immediately after the event, issued one meter precision DEM has been compared with a two meter precision one provided two years before. GIS maps with landslide and material deposit areas have been produced and analyzed.